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NOTE ON THE CARBONIFEROUS OF THE SANGRE DE CRISTO RANGE, COLORADO.

THE detailed section given below was taken at the crest of Sangre de Cristo range, directly west of Trinidad, Colo., between the sources of the Middle Fork and the North Fork of the Purgatory River. The Sangre de Cristo range reaches a maximum elevation in this region of 14,079 feet, in Mt. Culebra. From this peak northward the crest of the range descends gradually to an elevation of about 9,300 feet at Veta Pass, thence rises again to Sierra Blanca—14,413 feet—the highest peak in Colorado.

The crest of the Sangre de Cristo range is composed for the most part of coarsely crystalline rock flanked by sedimentaries. At the point where the section was taken the crystallines of the crest pass gradually beneath the surface, giving place to the sedimentary formations. From this point northward for a considerable distance the crest of the range is composed mainly of strata having a northeastward dip (see Hayden's *Atlas of Colorado*). Mr. Endlich maps a considerable portion of the sediments as Lower Carboniferous; but the greater part, including the barren red sandstones, which are several thousand feet thick in this region, is mapped as Upper Carboniferous. The red sandstones are obviously a part of the Red Beds, whose wide distribution in the mountain region is well known, but whose age is still a matter of doubt.

It was in the hope that some light might be thrown upon the age of certain isolated remnants along the eastern slope of the mountains that I took the trip to the fossil-bearing series at the crest of the range. In place of the Lower Carboniferous series which I had expected, I found the Upper Carboniferous series reported in the accompanying section. This section was taken in a cañon near the southern limit of what Mr. Endlich mapped as Lower Carboniferous. To the north of this point

the series attains a somewhat notable thickness, due mainly to the presence of strata younger than those represented in the section. Nearly all the layers of the section are more or less fossiliferous, but the most productive horizons are about 150 feet from the base. The 28-foot shale yielded thirty species. Some of these species were found at each of the horizons collected from. The lower 100 feet yielded few fossils, but none were found which could be referred to the Lower Carboniferous.

My collections were submitted to Dr. Stuart Weller, who very kindly identified the species for me and furnished the following lists: *Zaphrentis* sp. undet., *Orbiculoidea convexa* Shum., *Orbiculoidea missouriensis* Shum., *Chonetes mesoloba* N. & D., *Productus longispinus* Sow., *Productus costatus* Sow., *Productus cora* D'Orb., *Spirifer cameratus* Morton, *Spirifer rockymontana* Marcou., *Reticularia perplexa* McCh., *Seminula argentea* Shep., *Aviculopecten carboniferus* Stev., *Astartella concentrica* McCh., *Nucula ventricosa* H., *Nuculana bellistriata* Stev., *Pelecypod* (genera and sp. undet.), *Bellerophon percarinatus* Con., *Bellerophon carbonarius* Cox., *Bellerophon montfortianus* N. & P., *Bellerophon* sp. undet., *Rotella verrucelifera* White, *Soleniscus brevis* White, *Soleniscus* sp. undet., *Sphaerodoma texana* Shum., *Sphaerodoma* sp. undet., *Trachydomia wheeleri* Swall. var., *Naticopsis altonensis* McCh., *Naticopsis altonensis* var. *gigantea* M. & W., *Pleurotomaria perizomata* White, *Pleurotomaria* (several small species undet.), *Murchisonia copei* White, *Orthoceras* sp. undet., *Syringopora* sp., *Campophyllum torquium* Owen, *Straparolus catilloides* Con.

A few fossils were found as loose fragments and their horizons not determined. They are as follows: *Derbya crassa* M. & H., *Hustedia mormoni* Marcou., *Allorisina subcuneata* M. & H., *Schizodus wheeleri* Swall., *Bellerophon* (large sp. undet.), *Temnocheilus winslowi* M. & W., *Phillipsia* sp., large fish spine.

A small collection was also obtained from the western slope of Veta Pass, five miles above Placer. The section here is composed of sandstones, limestones, shales, and conglomerates simi-

lar to the section north of Mt. Culebra. The following species were found: *Zaphrentis* sp., *Orbiculoidea* sp., *Derbya crassa* M. & H., *Chonetes granulifera* Owen, *Chonetes mesoloba* N. & P., *Productus nebrascensis* Owen, *Productus costatus* Sow, *Spirifer cameratus* Morton, *Reticularia perplexa* McCh., *Seminula argentea* Shep., *Hustedia mormoni* Marcou, *Aviculopecten occidentalis*, *Astartella concentrica* McCh., *Schizodus Wheeleri*, Swall., *Bellerophon percarinatus* Con., *Bellerophon inspeciosus* White? *Soleniscus* sp., *Conularia*? sp., *Orthoceras* sp.

SECTION TAKEN AT THE CREST OF THE SANGRE DE CRISTO RANGE,
BETWEEN MIDDLE FORK AND NORTH FORK OF THE PURGATORY RIVER.

FEET.

- 10 Hard quartzitic conglomerate.
- 5 Dark shale.
- 2 Limestone, fossiliferous.
- 12 Red sandstone, with bands of red shale and irregular masses of limestone.
- 4 Greenish argillaceous sandstone.
- 18 Pink sandstone, argillaceous above, conglomeratic below.
- 4 Fossiliferous limestone.
- 10 Deep red sandstone, conglomeratic at the base, shaly near the top.
- 20 Limestone, arenaceous near the base.
- 13 Massive, light-colored grit, coarse and conglomeratic.
- 6 Banded sandstone and limestone intimately commingled. The limestone is often in more or less rounded masses. Irregular beds of gravel occur in places.
- 3 Nodular limestone.
- 8 Massive limestone.
- 3 Shale with limestone nodules.
- 23 Massive limestone.
- 20 Coarse sandstone, conglomeratic in the lower half.
- 8 Massive grit (local unconformity).
- 10 Calcareous shale, passing to black shale, with limestone nodules near the top.
- 15 Fossiliferous limestone with sandstone layers. Cup corals abundant.
- 6 Massive limestone.
- 8 Shale.
- 2 Coarse grit.
- 10 Sandstone with large nodules and irregular masses of limestone.
- 25 Shale with bands of sandstone and limestone.
- 4 to 12 Banded limestone.
- 28 Soft black shale, fossiliferous.
- 9 Coarse grit.
- 6 Black shale.
- 2 to 20 Coarse grit, conglomeratic in places.

- 45 Dark shale, with limestone nodules and thin seams of sandstone ; runs to massive limestone in places ; becomes red and arenaceous near the base.
- 7 Coarse grit.
- 10 Dark red shale, with nodules and irregular masses of limestone.
- 4 Limestone.
- 12 Red to black micaceous shale, with bands of sandstone near the base, and limestone nodules near the top.
- 10 Coarse grit.
- ? Red grit and conglomerate.
- Crystalline rocks of the mountains.

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